23rd Summer School on PARALLEL COMPUTING

Final coursework

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Heat equation

The distribution of heat over time is described by the so called heat equation:

$\frac{df}{dt} = \alpha(\frac{d^2f}{dx^2} + \frac{d^2f}{dy^2})$ for a function f(x,y,t).

This formula may be discretized in a regular grid G(:,:) by computing the new value G1(x,y) in a point (x,y) at each time step as:

G1(x,y) = G(x,y) + CX * (G(x+1,y) + G(x-1,y) - 2.0 * G(x,y))

+ CY * (G(x,y+1) + G(x,y-1) - 2.0 * G(x,y))

For each point in the grid the next value depends on the values of the four up and down, left and right adjacent points.

Coursework: Heat equation

The program Heat_2D_ser, either in Fortran or C, is intended to be used by the partecipants in the course to demonstrate their ability in using the optimizing techniques that have been acquired.

Parallel optimizations with MPI and/or OpenMP should be intensively applied to lower execution time on multi-node cluster platforms as much as possible.

Grid dimensions varying from 2000x2000 up to 4000x4000 should be used to compile a table of performance results with different number of parallel processors.